LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory April 28-May 2, 2014.

San Francisco Chronicle

GIVING SIGHT TO THE BLIND

The Argus II artificial retina, in which Lawrence Livermore has played a prominent roll, has enough resolution for people to see the lines of a crosswalk, find objects and read letters a couple of centimeters tall.

A Michigan man is one of the first recipients to get his sight back. Roger Pontz was diagnosed with retinitis pigmentosa as a teenager and has been almost completely blind for years.

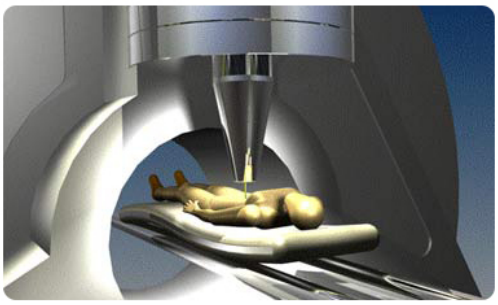
But thanks to a high-tech procedure that involved the surgical implantation of a "bionic eye," he has regained enough of his eyesight to catch small glimpses of his wife, grandson and cat.

Lawrence Livermore, in collaboration with four other national laboratories, four universities and Second Sight Medical Products, developed the first long-term retinal prosthesis that can function for years inside the harsh biological environment of the eye. The device takes images from an external video camera and sends electric impulses to an array implanted in the eye. These impulses stimulate the retina and enable the brain to perceive patterns of light.

To read more, go to *The San Francisco Chronicle*.

COMPASS
THE 3DEXPERIENCE MAGAZINE

READY-MADE EXPERTS



The compact proton radiotherapy treatment concept, which could be used to treat cancer patients.

Government agencies worldwide are experiencing an upward trend in outsourced contracts from private businesses looking to use advanced R&D facilities to enhance their position in the marketplace.

Lawrence Livermore joins the ranks of those government agencies. "Many corporates do not have the fundamental scientific research capabilities to produce this innovation, so they are capitalizing on the technology available in national labs to help them develop more products and increase their competitive position in the market," said Roger Werne, deputy director of industrial partnerships at Lawrence Livermore.

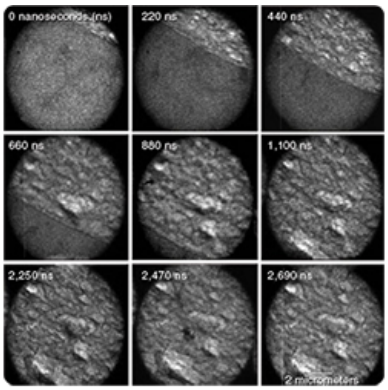
Compact Particle Acceleration Corporation (CPAC) recently developed a four-meter linear particle accelerator by adapting elements of LLNL's existing nuclear weapons and laser technology. Working with LLNL's research team, CPAC refined the technology for use in proton therapy, which is used to treat cancer patients.

The particle accelerator is expected to be deployed in various U.S. hospitals starting this year. By enabling doctors to treat solid tumors directly with minimal impact on surrounding tissue, the treatment is expected to reduce the tissue damage, compared to current radiation treatments.

To read more, go to *Compass Magazine*.

R&D 100
52 Years of Innovation

YOU'RE IN THE MOVIES



Nine dynamic transmission electron microscope movie frames record behavior occurring in a titanium–boron reactive multilayer film.

In 2010, Lawrence Livermore introduced an electron microscope that could study structural dynamics in condensed matter with the help of a nanosecond laser "pump" that captures images. The advancement earned LLNL an R&D 100 Award for technological innovation.

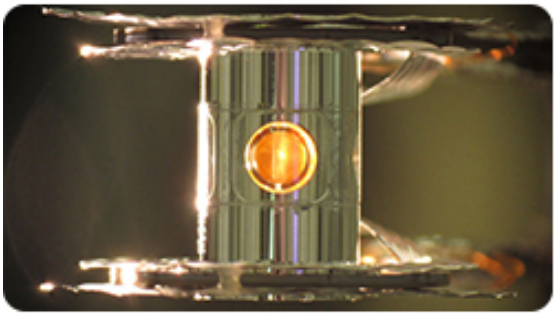
By 2013, the Laboratory won another R&D 100 Award for speeding up this process more than 100,000 times, resulting in a "movie-mode" version of the instrument.

The Movie Mode Dynamic Transmission Electron Microscope (MM-DTEM), captures billionth-of-a-meter-scale images with frame rates more than 100,000 times faster than those of conventional techniques. The work was done in collaboration with a Pleasanton-based company, Integrated Dynamic Electron Solutions (IDES) Inc.

Using this imaging technique, a range of fundamental and technologically important material and biological processes can be captured in action, in complete billionth-of-a-meter detail, for the first time.

To read more, go to *R&D Magazine*.

BBC NIF REACHES A RECORD OF ITS OWN



A metallic case called a hohlraum holds the fuel capsule for NIF experiments. Target handling systems precisely position the target and freeze it to cryogenic temperatures.

While the Jet experiment in Oxfordshire in England is aiming at achieving fusion -- the process that powers the sun -- Lawrence Livermore's National Ignition Facility (NIF) has achieved a record of its own.

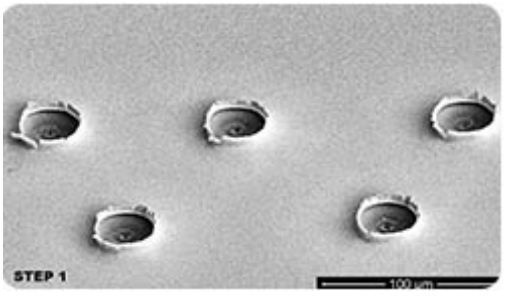
NIF takes a different approach to fusion from that taken by Jet and ITER concentrating laser energy on a hydrogen fuel pellet to initiate fusion.

During a run of the experiment in September 2013, the small amount of energy released through the fusion reaction exceeded the amount of energy being absorbed by the fuel -- a first at any fusion facility.

To read more, go to *BBC*.

USANEWS

PUTTING IRON TO THE STRESS TEST



A scanning electron microscopy image of the free surface of an iron sample after five separate laser-driven "shots."

Using an ultrafast laser system, a group at Lawrence Livermore has subjected iron to extremely rapid dynamic compression and has shown that the transition from one crystal structure to another can take place in less than 100 trillionths of a second after the compression begins.

If a material is squeezed hard enough, the way in which its atoms are arranged is often severely altered. In solids, pressure or stress may drive what are known as polymorphic transitions in which the crystal structure of the material changes from one form to another.

One of the best known of all such transitions is in iron and occurs at a typical stress of around 13 GPa (about 130,000 atmospheres of pressure). This transition has been very well studied over at least half a century since it was first inferred from shock wave measurements.

The team shows that the stress at which the transition occurs is substantially higher (up to twice) than reported for typical shock wave experiments where the compression occurs more slowly.

To read more, go to *USA News*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail